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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/589,399	08/14/2006	Guo-Quan Lu	124617.00118	7126

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BLANK ROME LLP
WATERGATE
600 NEW HAMPSHIRE AVENUE, N.W.
WASHINGTON, DC 20037

EXAMINER	
TAKEUCHI, YOSHITOSHI	
ART UNIT	PAPER NUMBER
1735	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/589,399	LU ET AL.	
	Examiner	Art Unit	
	YOSHITOSHI TAKEUCHI	1735	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 September 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12 and 14-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12 and 14-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-12 and 14-20 are presented for examination. Claim 13 is cancelled.

2. Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn.

Response to Declaration Under 37 CFR § 1.132

3. The declaration under 37 CFR 1.132 filed September 8, 2010 is sufficient to overcome the rejection of claims 1-12 and 14-20 based upon the showing that the temperature of volatilization of ethyl cellulose is not below the sintering temperature of nanoparticle silver, as had been asserted by the examiner.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 8, 11, and 18-19 recites the limitation "the step" in the first lines. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

6. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

7. Claims 1-12 and 14-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kodas et al (US 2003/0,108,664).

COMPOSITION

a. Regarding claim **1**, Kodas teaches a composition for use in fabricating electronic features (abstract) such as under bump metallization (¶0349, wherein under bump

metallization is "for forming an interconnect which performs at least one of mechanically, thermally or electrically connecting a device to a substrate"), comprising a conductive metal or metal alloy powder (¶0049, wherein the metal may include silver, palladium, gold, and platinum), composed of a plurality of nanoparticles; a dispersant associated with particles of the metal or metal alloy powder, said dispersant being present in sufficient quantity to reduce or prevent agglomeration of said particles of the metal or metal alloy powder (¶0132); and a binder that vaporizes having a temperature of volatilization below the sintering temperature of said metal or metal alloy powder (¶¶0128-29, including wax and PVA, which have a vaporization temperature below the sintering temperature of silver, as admitted by the applicants in ¶0027 of the instant specification).

While Kodas does not expressly teach the particle size being 500 nm or less, it teaches a plurality of nanoparticles with an average size of not greater than about 100 nm (¶0048), which is entirely within the instantly claimed range of 500 nm or less. As a result, it would have been obvious to a person of ordinary skill at the time of the invention to use particles with a particle size within the instantly claimed range of 500 nm or less, since Kodas teaches a range of particles that is entirely within the instantly claimed range.

b. Regarding claim **2**, Kodas teaches the composition of claim 1, wherein the particle size is "not greater than about 100 nanometers" (¶0049, which overlaps the instantly claimed range of 100 nm or less).

c. Regarding claim **3**, Kodas teaches the composition of claim 1, wherein the metal may include silver, palladium, gold, and platinum (¶0049).

d. Regarding claim **4**, Kodas teaches the composition of claim 1, wherein the dispersant is a fatty acid (¶0109, wherein the term "solvent" or "dispersant" itself does not patentably distinguish the instant invention from the prior art).

e. Regarding claim **5**, Kodas teaches the composition of claim 1, wherein the binder is a polymeric material (¶0129, e.g. polyvinyl acetals).

f. Regarding claim **6**, Kodas teaches the composition of claim 1, further comprising a viscosity adjusting component (¶¶ 0039 and 0131, wherein polyamic acid may be added to increase viscosity).

METHOD

g. Regarding independent claim **7**, Kodas teaches a method of fabricating electronic features (¶0003) such as under bump metallization (¶0349, which "performs at least one of mechanically, thermally, or electrically connecting a device to a substrate" and "positioned on contacts on the device and the substrate and sandwiched therebetween"), comprising step of: sintering (¶0061) conductive metal or metal alloy particles (¶0049, wherein the metal may include silver, palladium, gold, and platinum), where said low temperature processing is expected to form a conductive metal or metal alloy layer from said metal or metal alloy particles which performs one or more of mechanically, thermally, or electrically interconnecting the device and the substrate (see *supra*) and wherein said metal or metal alloy, prior to said step of sintering, is present in the form of a paste (¶0039, teaching one embodiment is a conductive paste) which comprises a

dispersant associated with the metal or metal alloy particles, said dispersant being present in sufficient quantity to reduce or prevent agglomeration of said metal or metal alloy particles (¶0132); and a binder having a temperature of volatilization below the sintering temperature of said metal or metal alloy particles. (¶¶0128-29, including wax and PVA, which have a vaporization temperature below the sintering temperature of silver, as admitted by the applicants in ¶0027 of the instant specification).

While Kodas does not expressly teach the particle size being 500 nm or less, it teaches a plurality of nanoparticles with an average size of not greater than about 100 nm (¶0048), which is entirely within the instantly claimed range of 500 nm or less. As a result, it would have been obvious to a person of ordinary skill at the time of the invention to use particles with a particle size within the instantly claimed range of 500 nm or less, since Kodas teaches a range of particles that is entirely within the instantly claimed range.

h. Regarding claim **8**, Kodas teaches the method of claim 7, to fabricate electronic features such as under bump metallization (¶0349, meeting the limitation, "the step of depositing on at least one electrical contact of at least one of the device and the substrate said metal or metal alloy particles," since bump connections are used to electrically, thermally, and mechanically connect a device and a substrate.

i. Regarding claim **9**, Kodas teaches the method of claim 8, wherein deposition may include screen printing. (¶0052).

j. Regarding claim **10**, Kodas teaches the method of claim 7, wherein the metal or metal alloy particle is about 100 nm or less (¶0048, which overlaps the instantly claimed range of 100 nm or less).

k. Regarding claim **11**, Kodas teaches the method of claim 7, which includes forming under bump metallization (¶0349), wherein the step of "further comprising the step of holding the device and the substrate together during the step of sintering" would be expected since the weight of the device weighs down on the bump material and the substrate and is expected in order to keep a good bump connection between the device and substrate, since bump connections are used to transfer electric and thermal energy away from the device and also mechanically hold the chip onto the substrate.

l. Regarding claim **12**, Kodas teaches the method of claim 7, wherein the metal or metal alloy is silver or silver alloy ¶0049).

m. Regarding independent claim **14**, Kodas teaches a method of fabricating electronic features (¶003) such as under bump metallization (¶0349, which is used to connect a substrate and a device, and wherein the steps of "positioning a paste between contacts of said substrate and said device" would be expected) paste (¶0039, teaching one embodiment is a conductive paste), wherein the paste comprises (i) a plurality of conductive metal or metal alloy particles (¶0049, wherein the metal may include silver, palladium, gold, and platinum); (ii) dispersant associated with the metal or metal alloy particles, said dispersant being present in sufficient quantity to reduce or prevent agglomeration of said metal or metal alloy particles (¶0132); and (iii) a binder having a

temperature of volatilization below the sintering temperature of said metal or metal alloy particles. (¶¶0128-29, including wax and PVA have a vaporization temperature below the sintering temperature of silver, as admitted by the applicants in ¶0027 of the instant specification); and heating the nanoparticles such that the polymers can decompose, enabling the nanoparticles to sinter together (¶0061, which suggests the temperature and time are sufficient to remove said binder and said dispersant), which in the under bump metallization embodiment (¶0349) would be expected the sintered metal or metal alloy layer would perform "at least one of mechanically, thermally, or electrically connecting a device to a substrate."

While Kodas does not expressly teach the particle size being 500 nm or less, it teaches a plurality of nanoparticles with an average size of not greater than about 100 nm (¶0048), which is entirely within the instantly claimed range of 500 nm or less. As a result, it would have been obvious to a person of ordinary skill at the time of the invention to use particles with a particle size within the instantly claimed range of 500 nm or less, since Kodas teaches a range of particles that is entirely within the instantly claimed range.

n. Regarding claim **15**, Kodas teaches the method of claim 14, wherein the metal or metal alloy is silver or silver alloy (¶0049).

o. Regarding claim **16**, Kodas teaches the method of claim 14, wherein the metal or metal alloy particle is about 100 nm or less (¶0048, which overlaps the instantly claimed range of 100 nm or less).

p. Regarding claim **17**, Kodas teaches the method of claim 14, wherein deposition may include screen printing. (¶0052).

q. Regarding claim **18**, Kodas teaches the method of claim 14 and heating the nanoparticles such that the polymers can decompose, enabling the nanoparticles to sinter together (¶0061, by selecting a binder that decomposes at or below sintering temperature of the nanoparticles, the instantly claimed step of "selecting said binder in said paste based on a desired temperature of volatilization" is met).

r. Regarding claim **19**, Kodas teaches the method of claim 14 and heating the nanoparticles such that the polymers can decompose, enabling the nanoparticles to sinter together (¶0061, by selecting and decomposing a binder that decomposes at or below sintering temperature of the nanoparticles, the instantly claimed step of "isolating said metal or metal alloy particles with said binder until a preset temperature during said heating step, wherein said preset temperature is determined based on said binder and a sintering temperature for said metal or metal alloy particles" is met).

s. Regarding claim **20**, Kodas teaches the method of claim 19 and heating the nanoparticles such that the polymers can decompose, enabling the nanoparticles to sinter together (¶0061, by sintering at a predetermined temperature the preset temperature is "is the same as or slightly below a sintering temperature for said metal or metal alloy particles").

8. Claim 11 is also rejected in the alternative to the one set forth *supra* under 35 U.S.C. 103(a) as being unpatentable over Kodas et al (US 2003/0,108,664) with evidence from Estes et al (US 6,189,208), in the event Kodas is not interpreted to meet the claimed holding step.

Regarding claim **11**, Kodas teaches the method of claim 7 as provided *supra*, which includes forming under bump metallization (¶0349), but does not expressly teach the step of "holding the device and the substrate together during the step of sintering."

Estes teaches a method of connecting a device to a substrate via bump connection (1:21-26) and teaches the importance of minimizing the final bump height for the best electrical, thermal, and mechanical properties. (2:28-30). As a result, it would have been obvious to a person of ordinary skill at the time of the invention to hold the device and substrate together during sintering in the invention of Kodas, since Estes teaches the importance of minimizing the final bump height for mechanical, thermal, and electrical properties.

Response to Arguments

8. Applicant's arguments with respect to claims 1-12 and 14-20 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Garbar et al (WO 2004/005,413).

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to YOSHITOSHI TAKEUCHI whose telephone number is (571) 270-5828. The examiner can normally be reached on Monday-Thursday 9:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jessica L. Ward can be reached on 571-272-1223. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/YOSHITOSHI TAKEUCHI/
Examiner, Art Unit 1735

/Jessica L. Ward/
Supervisory Patent Examiner, Art Unit 1735